Remarks

In view of the above amendments and the following remarks, reconsideration of the rejection and further examination are requested.

It is again respectfully requested that the Examiner acknowledge the claim for priority on the next Office Action summary form by checking the appropriate boxes in section 12 of the form.

Claims 1-11 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Forrest (US 4,709,413) in view of Marcuse (US 5,699,464) and Kaneko (US 4,815,807).

Claims 1, 3, 6, 8 and 9 have been amended so as to further distinguish the present invention from the references relied upon in the rejection.

In addition, claims 1, 3, 6, 8 and 9 have been amended to make a number of editorial revisions thereto. These revisions have been made to place the claims in better U.S. form. None of these amendments have been made to narrow the scope of protection of the claims, or to address issues related to patentability, and therefore, these amendments should not be construed as limiting the scope of equivalents of the claimed features offered by the Doctrine of Equivalents.

Claim 1 is patentable over the combination of Forrest, Marcuse and Kaneko, since claim 1 recites an optical transmission system having, in part, a transmitter for transmitting an optical signal through a multi-mode fiber, the transmitter including at least one lens having a vertex for converging an optical signal, wherein the vertex is located at a predetermined distance from an input plane of a multi-mode fiber, the predetermined distance is greater or less than a distance from the vertex to a focal point of the at least one lens, and the predetermined distance is determined based on a eye opening factor of the multi-mode fiber and a power of the optical signal, so that a numerical aperture of the optical signal is equal to or less than a first given value and the power of the optical signal is equal to or greater than a second given value. The combination of Forrest, Marcuse and Kaneko fails to disclose or suggest these features of claim 1.

Forrest discloses a single-wavelength, bi-directional, fiber-optic system having a pair of terminals 10 and 12 linked by a transmission fiber 14. Each of the terminals 10 and 12 is a transceiver which is capable of generating and receiving radiation at the same wavelength. Each of the terminals 10 and 12 includes a photodiode 22 having an active region 26 for receiving

radiation, a light source 16 for transmitting radiation, a lens (coupling means) 30 for coupling the radiation from the light source 16, through a hole 32 in the photodiode 22, into the fiber 14. (See column 3, line 11 - column 4, line 49 and Figures 1 and 2).

Based on the above discussion and the illustration of Figure 2, it is apparent that the lens 30 is positioned with respect to the fiber 14 such that the focal point of the lens 30 does not correspond with an input plane of the fiber 14. However, Forrest fails to disclose or suggest that the distance between the lens 30 and the input plane of the fiber 14 is determined based on an eye opening factor of the fiber 14 and a power of the radiation transmitted by the light source 16, so that a numerical aperture of the radiation is equal to or less than a first given value and the power of the radiation is equal to or greater than a second given value. Therefore, Forrest fails to disclose or suggest these features of claim 1. As a result, it is necessary for Marcuse and/or Kaneko to disclose or suggest these features in order for the combination of Forrest, Marcuse and Kaneko to render claim 1 obvious.

Regarding Marcuse, it discloses a system having a multimode fiber 60 terminated by fusion splicing a length of homogeneous glass 61 onto the end of the fiber 60. A lens 62 is attached to the end of the glass 61 opposite to the fiber 60. The insertion of the glass 61 between the fiber 60 and the lens 62 moves the end of the fiber 60 away from the lens 62, which allows the lens to form a real image. Further, the glass 61 acts to capture almost all of the optical energy emitted by the fiber 60 and focus the energy at a point. (See column 3, line 2 – column 4, line 31 and Figure 6).

While Marcuse discloses the use of the glass 61 as a spacer between the fiber 60 and the lens 62, it is apparent that there is no disclosure or suggestion of the length (Dm) of the glass 61 between the lens 62 and an input plane of the fiber 60 being determined based on an eye opening factor of the fiber 60 and a power of radiation transmitted by a light source, so that a numerical aperture of the radiation is equal to or less than a first given value and the power of the radiation is equal to or greater than a second given value. Instead, the length (Dm) of the glass 61 is determined by other factors so as to achieve the formation of the real image and the focusing of the optical energy at a point. As a result, Marcuse also fails to disclose or suggest this feature of claim 1.

Regarding Kaneko, it discloses a system whereby two optical fiber elements coupled with collimator lenses are spaced apart from each other by a distance l. One of the optical fiber

elements is connected to a laser source and the other optical fiber element is connected to an optical power meter. Depending on the types of collimator lenses used and the distance l, various power levels of the light from the laser source are received at the optical power meter. (See column 5, lines 36-47 and Figures 7 and 8(a)-8(g)).

While Kaneko does demonstrate that the distance l between the two collimator lenses has an effect on the power level of the light received at the optical power meter, it fails to contemplate a situation where a vertex of one the collimator lenses is located at a predetermined distance from an input plane of a multi-mode fiber. Further, Kaneko fails to disclose or suggest an eye opening factor of a multi-mode fiber. Therefore, it is apparent that Kaneko also fails to disclose or suggest a vertex of at least one lens being located at a predetermined distance from an input plane of a multi-mode fiber, the predetermined distance being greater or less than a distance from the vertex to a focal point of the at least one lens, and the predetermined distance being determined based on a eye opening factor of the multi-mode fiber and a power of the optical signal, so that a numerical aperture of the optical signal is equal to or less than a first given value and the power of the optical signal is equal to or greater than a second given value, as recited in claim 1. As a result, it is apparent that the combination of Forrest, Marcuse and Kaneko fails to render claim 1 obvious.

As for claim 3, it is patentable over the combination of Forrest, Marcuse and Kaneko for reasons similar to those discussed above in support of claim 1. That is, claim 3 recites, in part, at least one lens having a vertex located at a predetermined distance from an input plane of a multi-mode fiber, the predetermined distance being greater or less than a distance from the vertex to a focal point of the at least one lens, and the predetermined distance being determined based on an eye opening factor of the multi-mode fiber and a power of the optical signal, so that a numerical aperture of the optical signal is equal to or less than a first given value and the power of the optical signal is equal to or greater than a second given value, which features are not disclosed or suggested by the references.

Claim 6 is patentable over the combination of Forrest, Marcuse and Kaneko, since claim 6 recites an optical transmission system having, in part, a receiver including a receptacle for connecting to a multi-mode fiber to affix an output plane of the multi-mode fiber at a predetermined distance from a light-receiving plane of a light receiving element, wherein the predetermined distance is determined based on a core diameter of the multi-mode fiber, a

diameter of the light-receiving plane, and a maximum angle among angles of modes of the optical signal outputted from an output plane of the multi-mode fiber which are capable of entering the light-receiving plane, so that a numerical number of the light-receiving plane is equal to or less than a given value. The combination of Forrest, Marcuse and Kaneko fails to disclose or suggest these features of claim 6.

As discussed above, Forrest discloses the photodiode 22 having the active region 26 for receiving radiation from the fiber 14. (See Figure 2). However, as admitted in the rejection, Forrest fails to disclose or suggest a receptacle for connecting the fiber 14 to one of the terminals 10 and 12 at a predetermined distance, whereby the predetermined distance is determined based on a core diameter of the fiber 14, a diameter of the active region 26, and a maximum angle among angles of modes of the radiation outputted from the fiber 14 which are capable entering the active region 26 of the photodiode 22, so that a numerical number of the active region 26 is equal to or less than a given value. As a result, Marcuse and/or Kaneko must disclose or suggest these features in order for the combination of Forrest, Marcuse and Kaneko to render claim 6 obvious.

As discussed above, Marcuse discloses the glass 61 that acts as a spacer between the fiber 60 and the lens 62. Further, Marcuse discloses a formula which defines the length (Dm) of the glass 61 in relation to a radius (a) of a core 63 of the fiber 60, a radius (b) of the glass 61, and a refractive index of the glass 61. (See column 3, line 2 – column 4, line 31 and Figure 6). While Marcuse does define the length (Dm) of the glass 61 between the fiber 60 and the lens 62 based on the factors detailed above, it is apparent that these factors do not include the maximum angle among angles of modes of the optical signal outputted from an output plane of the fiber 60 which are capable of entering a light-receiving plane, so that a numerical number of the light-receiving plane is equal to or less than a given value. Further, it is apparent that Marcuse fails to disclose or suggest the claimed receptacle and instead relies on the fusion of the glass 61 to the fiber 60 and the lens 62. Therefore, Marcuse also fails to disclose or suggest these features of claim 6.

As for Kaneko, it discloses a system whereby two optical fiber elements coupled with collimator lenses are spaced apart from each other by a distance l. (See column 5, lines 36-47 and Figures 7 and 8(a)-8(g)). However, it is clear that Kaneko provides no disclosure or suggestion of determining a predetermined distance between an output plane of a multi-mode fiber and a light-receiving plane of a light receiving element based on a core diameter of a multi-

mode fiber, a diameter of the light receiving plane, and a maximum angle among angles of modes of an optical signal outputted from the output plane of the multi-mode fiber which are capable of entering the light-receiving plane, so that a numerical number of the active region 26 is equal to or less than a given value. As a result, the combination of Forrest, Marcuse and Kaneko fails to render claim 6 obvious.

As for claim 8, it is patentable over the combination of Forrest, Marcuse and Kaneko for reasons similar to those discussed above in support of claim 6. That is, claim 8 recites, in part, a receiver having a receptacle for connecting to a multi-mode fiber to affix an output plane of the multi-mode fiber at a predetermined distance from a light-receiving plane of a light receiving element, wherein the light-receiving element receives a lower order mode of an optical signal and a higher order mode of the optical signal is prevented from entering the light-receiving plane, and the predetermined distance is determined based on a core diameter of the multi-mode fiber, a diameter of the light-receiving plane, and a maximum angle among angles of modes of the optical signal outputted from the output plane which are capable of entering the light-receiving plane, so that a numerical number of the light-receiving plane is equal to or less than a given value, which features are not disclosed or suggested by the references.

As for claim 11, it is patentable over references relied upon in the rejections for reasons similar to those discussed above with respect to claim 1 and claim 6.

Because of the above-mentioned distinctions, it is believed clear that claims 1-11 are patentable over the references relied upon in the rejections. Furthermore, it is submitted that the distinctions are such that a person having ordinary skill in the art at the time of invention would not have been motivated to make any combination of the references of record in such a manner as to result in, or otherwise render obvious, the present invention as recited in claims 1-11. Therefore, it is submitted that claims 1-11 are clearly allowable over the prior art of record.

In view of the above amendments and remarks, it is submitted that the present application is now in condition for allowance. The Examiner is invited to contact the undersigned by telephone if it is felt that there are issues remaining which must be resolved before allowance of the application.

Respectfully submitted,

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